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The Mountain Pine Beetle

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The mountain pine beetle, *Dendroctonus ponderosae* (Hopk.), is one of the most destructive forest insects in the Western United States and Canada. Since 1910 it has killed billions of board feet of commercial timber. Single infestations have almost totally depleted merchantable lodgepole pine forests in Montana, Idaho, and Wyoming. In the northern Rocky Mountains and in Washington and Oregon, western white pine has been severely attacked. In California the destruction of sugar pine alone is estimated to be between 5 and 10 billion board feet. In the Black Hills of South Dakota and the southern Rocky Mountain region, the beetle kills ponderosa pine. It accounts for much tree killing in dense stands of pole-size ponderosa pine in Oregon and Washington.

Infestations in pure stands of lodgepole pine in the Rocky Mountains, Cascade Range, and Sierra Nevada often develop rapidly and maintain outbreak status until every tree more than 3 inches in diameter is killed. In mature sugar pine and western white pine forests, infestations are more often limited

to single trees or small groups of trees. Although they often subside naturally after killing a comparatively small part of the stand, repeated and sometimes almost chronic outbreaks eventually deplete a stand seriously.

The beetle is found over a wide range from the Pacific coast eastward through the Black Hills of South Dakota, northeastward through southern British Columbia and Alberta, and southward through northern Mexico (fig. 1). It ranges in elevation from 2,000 feet above sea level in the northern latitudes to as high as 12,000 feet in the southern latitudes.

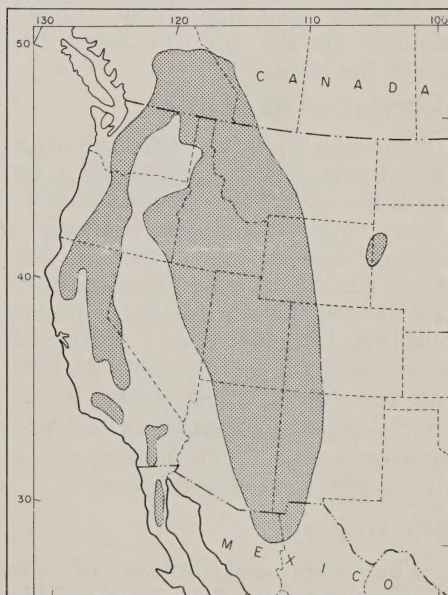


Figure 1.—Infestation areas of the mountain pine beetle in the western United States, Canada, and Mexico.

¹ Synonymy: Combines mountain pine beetle, *Dendroctonus monticolae* Hopk., and Black Hills beetle, *D. ponderosae* Hopk. See Wood, Stephen L. The Great Basin Naturalist 23 (1-2): 57-69. 1963.

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Hosts

Western white pine, sugar pine, and lodgepole pine are preferred hosts. But attacks of the beetle in ponderosa pine, white-bark pine, and limber pine sometimes cause extensive killing of these host trees.

Evidences of Infestation

Infested trees start fading within a few weeks to a year after attack. The foliage changes from green to yellowish green, sorrel, and rusty brown. The rate of fading is influenced by several factors—tree species, season and intensity of attack, and climatic conditions. In the warmer part of its range, sugar pine begins to fade sooner than similarly attacked western white pine or lodgepole pine.

Newly infested trees may be detected by pitch tubes and boring dust in the bark crevices. Pitch tubes are masses of reddish, amorphous resin mixed with bark and wood borings, and vary from 1/2 to 3/4 inch across. Each tube marks a beetle entrance or attack and is formed in an attempt to rid tunnels of resins exuding from initial wounds in the phloem layer beneath the bark.

Description of Stages

The beetle passes through egg, larval, pupal, and adult stages in its development. The minute, pearly-white eggs hatch into yellowish-white, legless grubs, or larvae. After passing through three instars the larvae transform into pupae and then into adults. Newly formed adults are yellowish brown at first but turn black at maturity. These short-legged, stout, cylindrical creatures, about 3/16 inch long, can fly readily to new host trees.

Life History

The wide distribution of the beetle accounts for considerable variation in its life history. One generation emerges annually in

most of the range. The beetle attacks during June, July, and August. The resulting broods overwinter as new adults and mature and young larvae. Two generations a year and often the beginning of a third develop in the relatively warm climates below the 7,000-foot elevation southward from latitude 40° N.

Habits

Parent adult beetles attack by boring through the bark to the inner surface, then tunneling upward to form the egg gallery, which often extends for 30 inches or more. In sugar pine the galleries are often irregular and winding. The insect places eggs along each side of the gallery in individual niches (fig. 2, *A*). Both the niches and egg galleries are tightly packed with partially digested woody particles, or frass.

Heavily attacked trees have egg galleries spaced 1 to 2 inches or more apart around the entire main trunk. The attacks occur from near the ground upward to about a 6-inch diameter at the top. In sugar pine, western white pine, and ponderosa pine they often extend into the larger limbs. In lodgepole pine the initial attacks are concentrated in the lower trunk, and later attacks by secondary species of bark beetles affect the upper part.

After hatching, the larvae (fig. 2, *B*) feed constantly on the inner bark or phloem in individual channels. Their larval mines extend 1 to 5 inches at right angles from the egg gallery. The larvae then excavate shallow oval pits in which they transform into pupae (fig. 2, *C*) and later into adults (fig. 2, *D*). As the new adults mature, they emerge from these cells or from interconnecting cavities by boring to the outer bark surface.

Natural Control

Parasites, predators, and weather are important for the natural con-

trol of the beetle. Predaceous insects and woodpeckers are particularly effective. After a beetle buildup predators and parasites become

fully effective when their populations have multiplied. Two species of coleopterous predators, *Enoclerus sphegeus* Fab. and *Temnochila*

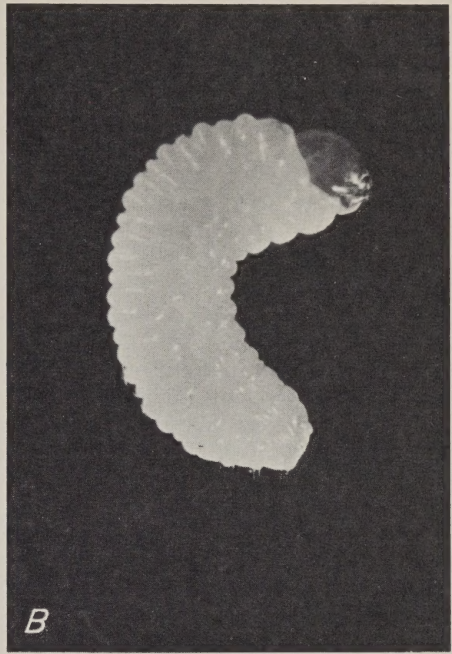


Figure 2.—Mountain pine beetle: A, Eggs; B, larva; C, pupa; D, adult.

virescens (Fab.), are important, especially in thick bark. Several parasitic wasps and a few predaceous flies occur in thin bark. Also several species of parasitic mites and nematodes may contribute to control. Infrequently, sudden below-freezing autumn or prolonged subzero winter temperatures kill the beetles.

Applied Control

When attacked, overmature and decadent trees may serve as breeding reservoirs for outbreak populations. The problem is severe in old-growth virgin stands, especially of western white pine and sugar pine. Where permissible, removal of the larger, older trees by logging before they are attacked reduces much of the beetle hazard of the host forests while salvaging much of their lumber value.

Infestations of windthrown timber or of large-diameter slash from logging or clearing have often led to outbreaks in sugar pine. These can be prevented through prompt cleanup of such material by salvage logging, limbing, spraying, peeling, and burning.

Direct control methods to destroy broods of the beetle are widely used. Toxic penetrating sprays applied to the exposed bark surfaces of infested trees kill broods within the bark and phloem. Thin-bark trees may be sprayed without felling if infestations are within reach. Trees having infestations beyond reach must first be felled.

The previously used formulations of orthodichlorobenzene and ethylene dibromide are being rapidly replaced by cheaper and more effective sprays containing lindane. Oil solutions of 1.5 percent lindane are highly efficient in killing broods, preventing attacks in fresh slash or snow breakage, and protecting living trees against attacks. On surfaces of infested bark lindane sprays can penetrate and kill more than 90 percent of the beetle broods.

The killing action is by contact and fumigation. Enough spray is applied to wet the bark surface. Thoroughly blended formulations are prepared from commercial oil solution concentrates containing a known amount by weight of lindane. Lindane may be purchased in pure form (100 percent gamma isomer) or as a stated percentage gamma isomer of benzene hexachloride (BHC).

Warning: As a concentrate or mixed solution for spraying, lindane is toxic when swallowed, inhaled, or absorbed by the skin. Do not breathe spray mist. If the skin becomes exposed, wash it with soap and water. Avoid fire—mixed sprays are as flammable as diesel oil. Because of its possible toxic effects on fish, domestic animals, and wildlife, avoid indiscriminate use of lindane. Always mix and apply it in the open. Follow the directions on the label.

References

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